

# ABSTRACT

The invention provides a negatively charged oxygen atom production system adapted to heat a member comprising a calcium aluminate composite material for extraction of negatively charged oxygen atoms. The calcium aluminate composite oxide in a thin-film form is formed on a substrate comprising a zirconia plate or yttria-stabilized zirconia, and a heater for heating the member is formed near the thin film comprising said calcium aluminate composite oxide, or it is integrally formed within the substrate or near its surface. Alternatively, the calcium aluminate composite oxide in a thin-film form is formed on a steatite ceramic heater. The calcium aluminate composite oxide has calcium oxide and aluminum oxide at a molar rate of 12:7.